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January 13, 1988

TO THE MEMBERS OF THE CABLE ADVISORY BOARD:

Attached is an interim report to the Governor which I plan to deliver on Friday. I believe it expresses the consensus which our Board has reached in its last two meetings. Speed is essential in order to get our legislative recommendations before the legislature. The draft legislation is now being redrafted and will be enclosed if received in time. Please call me on Thursday, January 14, if you have any changes to propose in the report.

William F. Quinn
WILLIAM F. QUINN

WFQ:vbw
Attachment

THIS LETTER
MARKED URGENT

GOVERNOR'S ADVISORY BOARD ON THE
UNDERWATER CABLE TRANSMISSION PROJECT

PRELIMINARY REPORT

January 15, 1988

I. INTRODUCTION

On August 7, 1987, Governor John Waihee established the Governor's Advisory Board on the Underwater Cable Transmission Project, hereinafter referred to as the "Cable Board", or "Board". Members of the Board appointed by the Governor are:

William F. Quinn (Chairman)
Roger A. Ulveling (Vice Chairman)
John D. Bellinger
Dante K. Carpenter
Paul Finazzo

Sheridan C.F. Ing
Fujio Matsuda
Russell K. Okata
William W. Paty, Jr.
Howard Tasaka

The purpose of the Board, as initially stated, was:
"to advise the Governor on:

(a) the technical, economic, financial and social feasibility of the construction of an underwater cable transmission system between the islands of Hawaii, Maui and Oahu to transmit geothermal energy produced on the Big Island; and

(b) the appropriate role of State government in the financing, construction, operation and ownership of the cable system."

The Board's responsibility was subsequently expanded to include "geothermal development as an integral part of the cable system, and determine how both can be developed in consort with respect to such issues as permitting, financing, and institutional development".

Financial support for the Board, in the amount of \$200,000, was provided by the State Legislature (Act 216, SLH 1987).

The Cable Board has reached tentative conclusions that geothermal development and underwater cable transmission are technically, economically, financially and socially feasible. It is too early to determine whether the entire project can be developed by private entities or, if not, the extent of the role State government must play in the financing, construction, operation and ownership of the geothermal project. If the legislative recommendations made in this report are accepted, and a master coordinated development plan is drawn and permitted, we can then readily determine the capability of the private sector to carry out the plan, and the extent of State assistance or participation that is required.

This report sets forth the preliminary views and recommendations of the Cable Board based upon its activities to date.

II. BACKGROUND

Hawaii's deep concern for its energy future is a result of the State's extremely high reliance upon petroleum in an unstable world oil market. Despite the current world oversupply and the recent decline in price, there is widespread opinion that the current worldwide surplus oil production capacity will likely be exhausted in less than a decade. Thereafter an escalation in oil price is expected. Energy experts differ greatly as to exactly when and how rapidly prices will rise. This uncertainty emphasizes the need for Hawaii to take active measures to reduce its oil dependence and improve its energy stability and security. This need becomes imperative in the light of the serious negative impact of high energy costs on our State economy.

Petroleum accounts for ninety percent of Hawaii's total energy supply, twice the national average. In the case of electrical power generation, the contrast between Hawaii and the rest of the nation is even greater. While the nation's utilities have reduced their use of oil to a point where petroleum products now account for only about five percent of the fuel consumed for power generation, Hawaii's utilities have continued to rely almost entirely on oil. Nationally, coal is the leading source of energy for power generation, accounting for fifty-six percent of

the fuel used. Locally, coal will be used for the generation of power on Oahu for the first time starting in 1989. The feasibility of coal as a cheaper substitute for oil than geothermal power will be further discussed below.

Recognizing Hawaii's energy vulnerability, the Hawaii State Plan, adopted by the State Legislature in 1978, set forth the following energy objectives:

Dependable, efficient, and economical statewide energy...systems capable of supporting the needs of the people; and

Increased energy self-sufficiency.

To meet the objectives stated above requires serious consideration of the use of locally available energy resources. There are several candidates in various stages of technical maturity. However, geothermal energy is the only near-term indigenous source which can bring about significant energy self-sufficiency in Hawaii.

Geothermal energy has proven to be technically and economically feasible elsewhere. The resource appears to be available in sufficient quantity on the Big Island to satisfy at least half of the State's total electricity requirements. Because geothermal resources are located primarily on the Big Island, and Oahu represents eighty percent of the demand, successful utilization of geothermal energy requires transmission of electric power between the islands. The most feasible method of transporting electricity under the conditions involved is by high-voltage, direct-current (HVDC) submarine cables. Such a transmission method has been under study for several years.

The Hawaii Deep-Water Cable (HDWC) Program, a \$27 million project funded by the Federal Government and the State, was started in 1980. Its purpose is to develop the technology of a cable system to transmit electricity between the islands of Hawaii. This requires a transmission cable capable of traversing a distance of 150 miles in ocean depths down to 6,300 feet. This is twice the distance and four times the depth of the longest and deepest cable laid to date anywhere in the world. The HDWC has produced a design for an electric transmission cable which will probably satisfy Hawaii's requirements. A segment of a cable meeting design requirements is now undergoing electrical and mechanical testing in the laboratory. These tests will run for about a year, beginning

in late 1987. Materials testing to confirm a thirty-year operating life of component systems will be completed in early 1988. Following these tests, the validity of the subsystem integration plans will be tested in 1989 at sea with a six mile length of cable. The technical feasibility of a cable system for commercial application will be confirmed with the completion of at-sea tests. Ocean bottom surveys have identified a feasible cable route linking Hawaii with Maui and Oahu.

The Hawaiian Electric Company, providing Oahu with electricity, will be the buyer of power produced and transmitted by the geothermal project. It has confirmed that the utility system on Oahu is capable of accepting 500 megawatts of "competitively priced" baseload geothermal power phased in between 1995 and 2006. This is the basis upon which cable and geothermal development planning has proceeded to date. Preliminary design studies have been undertaken to link Hawaii and Oahu with a 500 MW transmission system, with an option to provide a 50 MW power tap on Maui. The cable system is estimated to cost about \$450 million, with the geothermal development for 500 MW estimated to cost approximately \$1.3 billion in 1986 dollars.

Private investments made to date for geothermal development in Hawaii exceed \$20 million, although no commercial plant has yet been constructed. Presently there are two joint venture firms actively involved in geothermal development activities on the island of Hawaii -- Puna Geothermal Venture and True/Mid-Pacific Geothermal Venture. Puna Geothermal Venture has entered into contract with the Hawaii Electric Light Company on the Big Island to provide 25 MW of geothermal power in 1991 to meet the island's needs. True/Mid-Pacific Geothermal Venture has been battling for years to get the necessary permits to start exploration for geothermal resources. Although it is now before the United States Supreme Court, it is anticipated that its permits will soon be confirmed and it can at long last begin its work. It will have land-use approval for the development of up to 100 MW of geothermal power. True/Mid-Pacific has also indicated an interest in developing geothermal energy on Maui.

Development of geothermal energy in Hawaii has been slow. The Report to the Thirteenth State Legislature In Response to Senate Resolution No. 140 Requesting the Department of Planning and Economic Development to Expedite Geothermal Development, contains a number of reasons

for the delay. Private developers are reluctant to undertake the risk of large-scale geothermal exploration and development in the absence of an assured market. The market in turn depends upon the availability of an inter-island transmission system. Burdensome permitting policies and procedures as administered by various government agencies have obstructed progress in development. Strong encouragement and cooperation by the State and Hawaiian Electric Company are required if geothermal energy is to provide some energy self-sufficiency for Hawaii.

The State Legislature has supported geothermal development in recent years by adopting several bills intended to encourage development. Bills to establish geothermal resources subzones, to delete the provisions for contested case hearings on geothermal development activities, and to give the BLNR flexibility with respect to royalty payments to the State have offered significant encouragement.

There is wide public support for geothermal energy development. An August 1987 opinion poll indicated that eighty-four percent of the statewide population favor geothermal development, with only seven percent opposed. On the Big Island, seventy-five percent were in favor of geothermal development while five percent were opposed at the time of the poll.

III. ACTIVITIES OF THE BOARD TO DATE

The Board reviewed numerous studies and reports provided by DBED and related to both geothermal and transmission cable development, and also studied reports concerning legal, financial, and institutional issues concerning large-scale, commercial geothermal/cable development in Hawaii.

The Board met in formal session seven times between September 8, 1987 and January 8, 1988 for discussion and to receive detailed reports from the two firms presently engaged in geothermal development work in the State. The Board also had productive sessions with the program manager for the Hawaii Deep Water Cable program; representatives of international cable manufacturers from France, Italy, Japan, Norway and Sweden; a financial advisor; an economic consultant; and legal counsel.

In reviewing the economic feasibility of a geothermal/cable system, the Board reviewed the life-cycle benefits and costs of this system in comparison with oil-fired

generation. Other alternatives, such as coal and natural gas, which would have to be imported into the State, have not yet been studied. While the cost of coal imported to Hawaii as projected into the future may appear to cast doubt on the competitiveness of geothermal power, coal importation would offer no self-sufficiency to Hawaii. Also, there are other considerations which the Board has not yet been able to study. These include the full range of societal benefits, costs and risks which may be involved in developing an indigenous source of energy as compared with imported energy. The security of energy supply is an important consideration which is difficult to quantify in any economic analysis.

IV. PRELIMINARY OBSERVATIONS AND CONCLUSIONS

Presented below are preliminary observations and conclusions which the Board has reached:

a. World oil market conditions are leading to rapidly increasing dependence by the United States on foreign sources of supply. Our nation's vulnerability to future escalations in the price and shortages of petroleum supplies can increase to dangerous levels within a relatively short period of time. Because of the severe impact on the State's economy from a high cost or short supply of oil, Hawaii must reduce, as rapidly as possible, its extreme dependence upon petroleum as an energy source.

b. Geothermal energy conversion is a proven technology which is commercially mature. Scientists estimate that the entire Kilauea East Rift Zone contains sufficient heat to satisfy Oahu's electrical needs several times over. However, conservative considerations of a constant reliable supply of power suggest that a fifty percent conversion of Hawaii's generation capacity to geothermal is sound. Exploration drilling of about 25 wells at a cost of \$2 million per well will be needed to provide 500 MW of power. It may be that more than 25 wells must be drilled. Even with the vast resource believed to exist, some wells may prove non-productive.

c. The HDWC program will confirm the technical feasibility of the electric cable transmission system by 1990. Furthermore, major cable manufacturers have expressed their view that they could cope with any remaining technical uncertainties in the event that a decision is made to proceed immediately with the design and construction of the system.

d. The concept of a 500 megawatt geothermal/cable development which transmits power generated from geothermal resources on the Big Island to Maui and Oahu appears to be technically feasible, and economical, when compared with oil-fired generation under assumed future oil prices and other conditions. Whether a geothermal/cable system is more economical than generation of electricity on Oahu using other alternative fuels needs further study including consideration of social as well as economic aspects.

e. Geothermal and cable development should be undertaken as a single enterprise in order to expedite development. The two elements are so interdependent that separate development would be impracticable.

f. Several international firms have expressed their readiness to undertake the development of geothermal resources and the transmission cable as a single integrated enterprise, with private financing and under private ownership, provided they are supported in their efforts by the State in ways which have not been fully defined.

g. The State must take a strong leadership role in providing for and facilitating the coordinated development of both geothermal resources and cable system. An appropriate entity should be empowered by the State to carry the development forward.

h. A project such as the geothermal project faces a ponderous assortment of Federal, State and County land use, planning and other related laws and regulations. They tend to be repetitive, duplicative and uncoordinated. Experience has shown they consume unreasonable amounts of time, effort and expense. A project like the one under consideration has never been attempted in Hawaii. Because of its magnitude and geographical spread, the project will require a great many permits and overlapping jurisdiction by a number of agencies. Therefore, there is a strong need to establish a comprehensive and unified permitting system which can minimize the time, effort and expense involved for such a large and complicated undertaking.

V. RECOMMENDATIONS

a. Establish through the legislative process a State policy which declares that energy diversification with respect to future electricity supply is of priority importance to the State. Establish a goal of providing at least fifty percent of Hawaii's electricity needs by the year 2010 through geothermal or other indigenous and renewable energy sources, if determined to be feasible. The test for feasibility should include considerations of energy security, economic and environmental impacts, and other factors related to overall societal benefits and costs.

b. Establish a Public Authority, created by the State, to determine the feasibility of this project; to prepare a master development plan; to act as the State's central leading agency for the application and facilitation of permitting actions; and to otherwise ensure timely development of the project through the private sector.

c. Establish a special purpose permit system for the project.

d. Draft legislative bills for (b) and (c) are attached.

e. It is imperative that legislative action be taken in the upcoming session of the legislature. Hawaiian Electric Company, Limited, the prospective purchaser of the electricity generated by the geothermal project has stated that it foresees a demand for an additional 500 MW of power phased in between 1995 and 2006. However, if tangible progress toward the development of geothermal power is not made well in advance of 1995, the company may be forced to look to other generation sources. If the State is able to design the master development plan for the project and have the plan permitted by 1991, then it would appear that geothermal power could be produced to meet the requirements of Hawaiian Electric for 500 MW of power starting in 1995 and the State's goal of significant energy self-sufficiency could be achieved. To achieve that goal requires early legislative action.

William F. Quinn, Chairman
Governor's Cable Advisory Board